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This document is part of a collection that serves two purposes. First it is a public archive for data and documents resulting from evolutionary, ecological, and behavioral research conducted by the Ketterson-Nolan research group. The focus of the research is an abundant North American songbird, the dark-eyed junco, *Junco hyemalis*, and the primary sources of support have been the National Science Foundation and Indiana University. The research was conducted in collaboration with numerous colleagues and students, and the objective of this site is to preserve not only the published products of the research, but also to document the organization and people that led to the published findings. Second it is a repository for the works of Val Nolan Jr., who studied songbirds in addition to the junco: in particular the prairie warbler, *Dendroica discolor*. This site was originally compiled and organized by Eric Snajdr, Nicole Gerlach, and Ellen Ketterson.

Context Statement

This document was generated as part of a long-term biological research project on a songbird, the dark-eyed junco, conducted by the Ketterson/Nolan research group at Indiana University. For more information, please see IUScholarWorks (<https://scholarworks.iu.edu/dspace/handle/2022/7911>).

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Behavioral Consequences of Elevated Testosterone in Female Dark-Eyed Juncos (*Junco hyemalis*)

Dustin G. Reichard¹, Dawn M. O'Neal², and Ellen D. Ketterson²

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ABSTRACT

Through experimental elevation of plasma testosterone (T), novel phenotypes can be created and tested for relative fecundity and viability and thus for likelihood of being favored by natural selection. Previous studies have shown that elevated T in male dark-eyed juncos (*Junco hyemalis*) results in greater fitness due to increased mating success, despite reductions in parental care. The constraint hypothesis predicts that this fitness gain might be offset by deleterious effects of elevated T in females, which may explain why high T males have not evolved. In the female dark-eyed junco, previous studies have suggested that females are behaviorally insensitive to T during the incubation stage, which argues against the constraint hypothesis. In this study, in an effort to determine potential fitness consequences associated with elevated T, we asked whether experimentally elevated T affects maternal aggression towards conspecifics during incubation or brooding of nestlings. Incubating females implanted with T-filled or empty implants were presented with a conspecific male at the nest, and attack intensity was measured for fifteen minutes. Brooding behavior of females and male provisioning were observed for three hours when nestlings were three days old. Increased T had no effect on maternal aggression, providing additional support for female insensitivity to T during incubation. Conversely, high T females spent less time on the nest and spent less time brooding than control females, suggesting that aspects of female parental behavior are sensitive to T during the nestling stage. Further study will show whether these aspects might prove detrimental and conceivably constrain the evolution of T in females or males.



INTRODUCTION

-Experimentally elevated T in male dark-eyed juncos reduces parental care, but increases overall fitness due to extra pair fertilizations.¹

-Why are we not seeing selection for higher male T?

-If elevated T results in a fitness loss in females, then females could constrain high T levels in males.²

-Alternatively, female traits ordinarily sensitive to androgens could be insensitive if the fitness costs associated with sensitivity are high.³

-What effect might high T have on maternal aggression and nestling brooding?

HYPOTHESES

-T-females will exhibit increased aggression towards conspecifics at the nest to correlate with increased aggression in captive studies

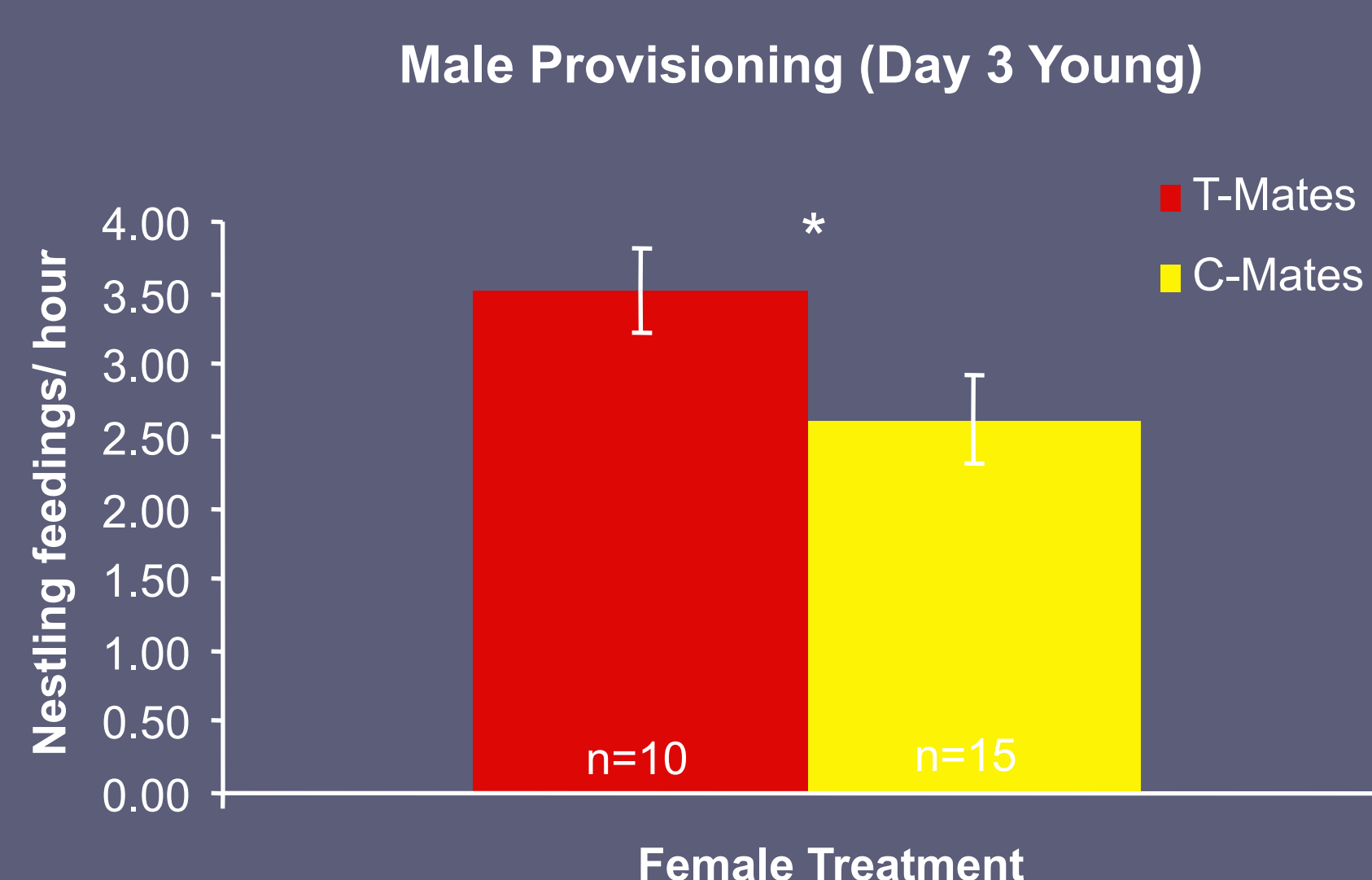
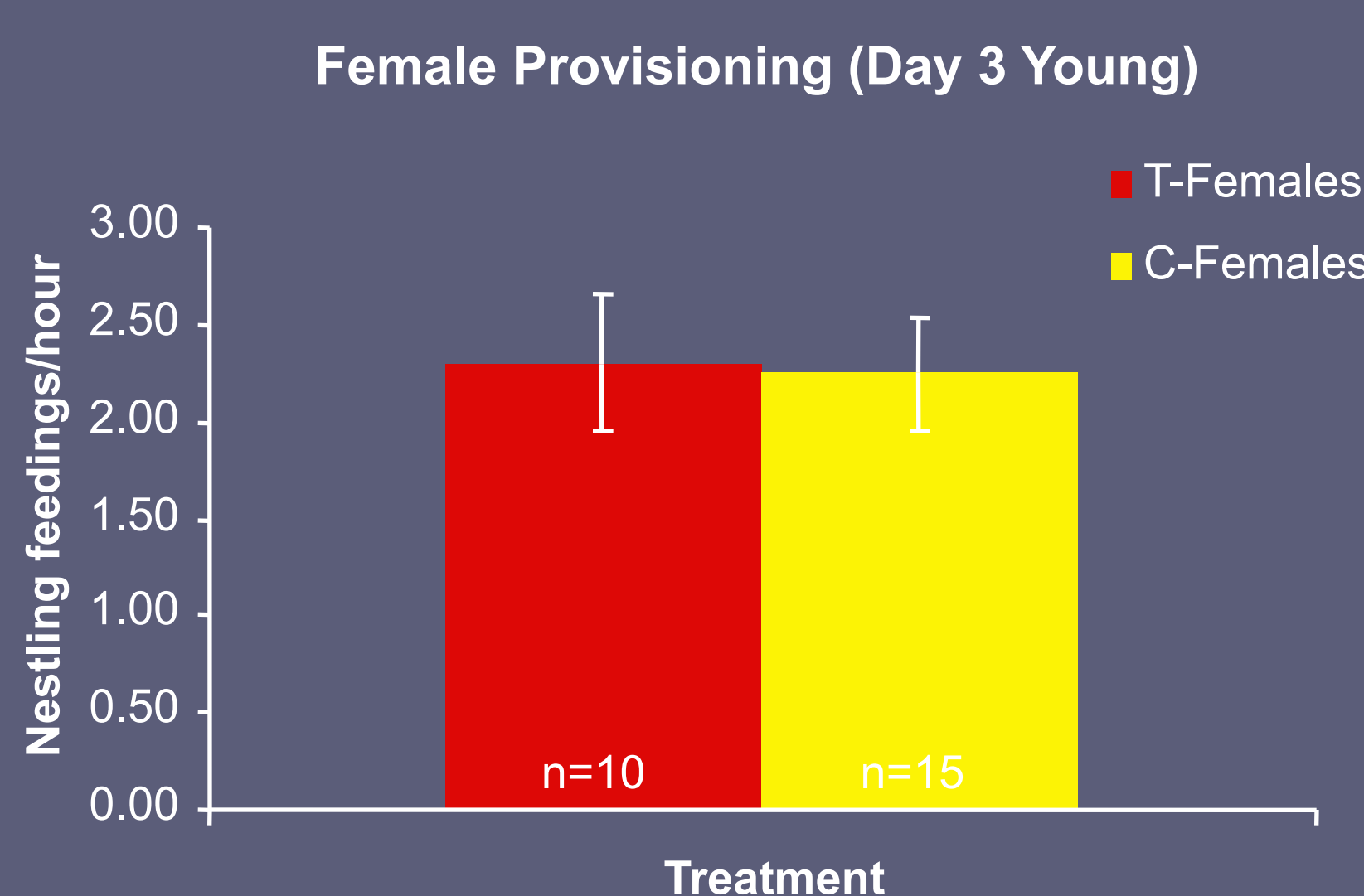
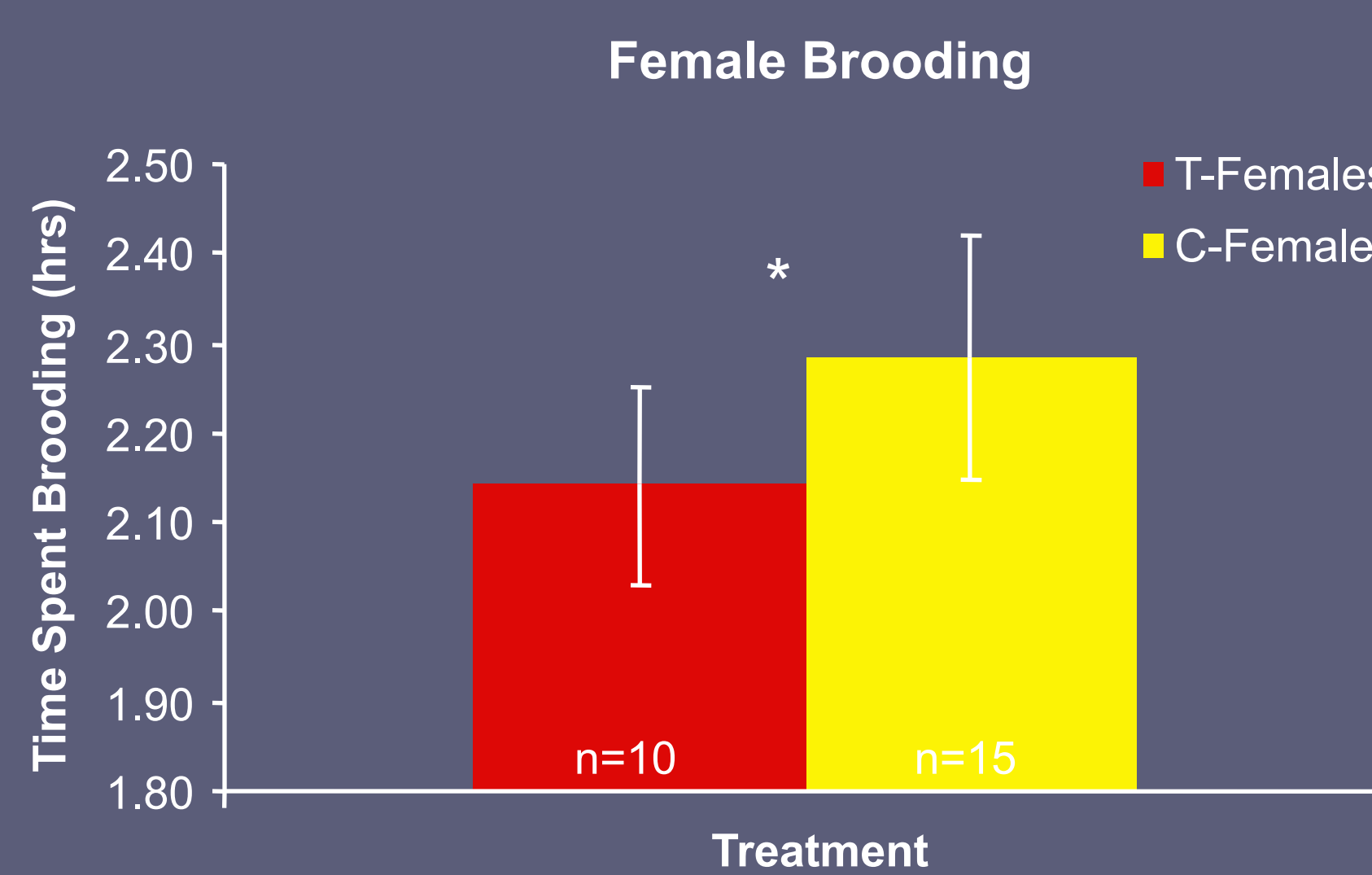
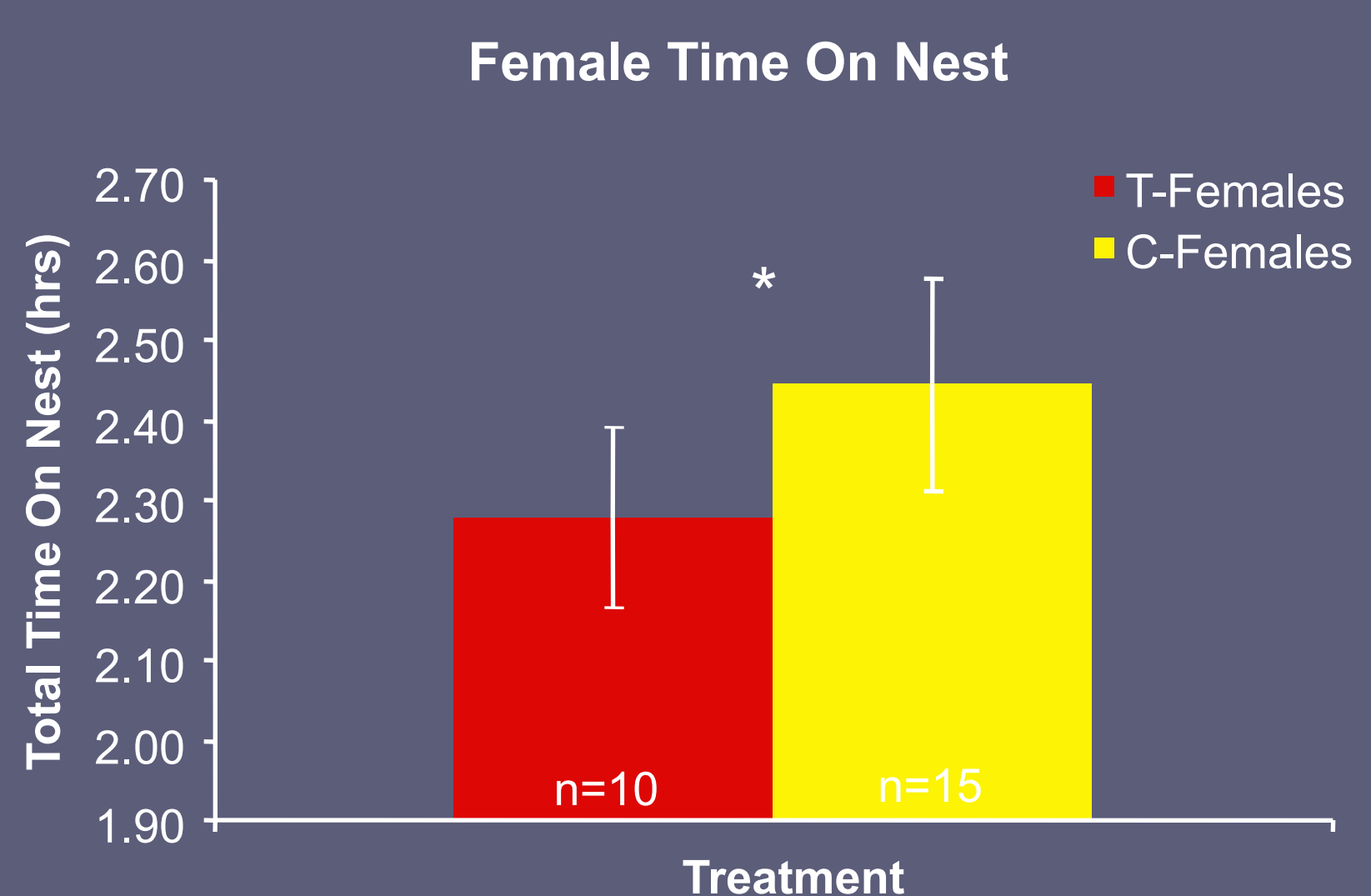
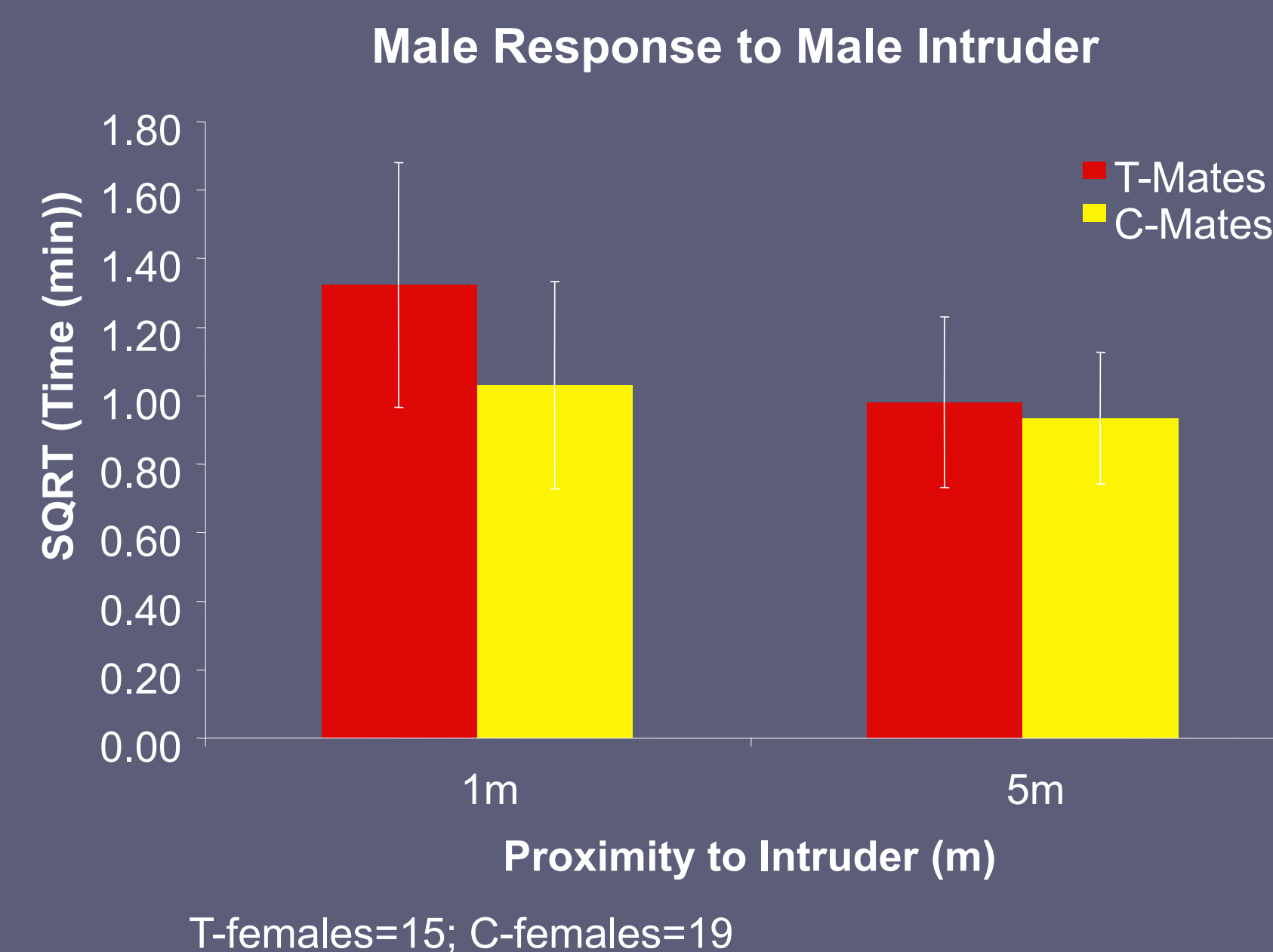
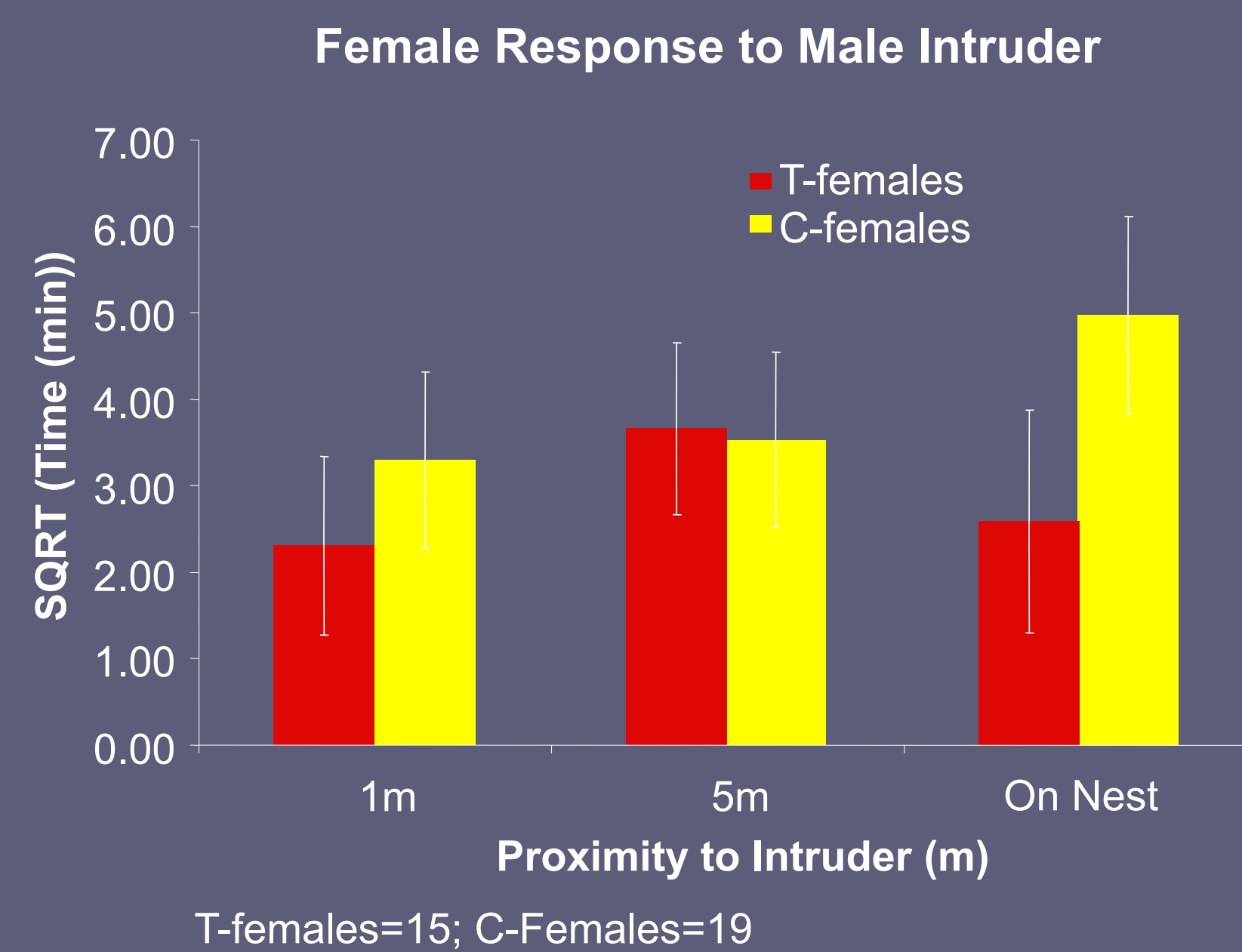
-As the primary caregiver, females will remain insensitive to testosterone during the nestling stage.

METHODS

-89 females received 5 mm subcutaneous silastic implant of crystalline T or an empty implant

-After clutch complete, simulated nest intrusion with caged conspecific male for 15 minutes, recorded male and female proximity to the cage (1m and 5m) and aggressive behaviors (dives and hits)

-Day 3 after hatching, nest videotaped for 3 hours and brooding and provisioning rates scored



LITERATURE CITED

¹Reed, W.L. et al. 2006. American Naturalist. 167.

^{2,4}Clofelter, E.D. et al. 2004. Hormones and Behavior. 46:171-17

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RESULTS

-No significant effect of high T on maternal aggression during conspecific nest intrusions

-High T females spent significantly less time on the nest than control females ($p < 0.05$) (Mean Diff. – 10.00 minutes)

-High T females spent significantly less time brooding than control females ($p < 0.05$) (Mean Diff. – 8.49 minutes)

-No significant difference in female provisioning rate between treatments ($p > 0.05$)

-Males mated to high T females provisioned young significantly more often than males mated to control females ($p < 0.05$) (Mean Diff. – 0.90 provisions/hr)

DISCUSSION

-This study provides the first evidence of female sensitivity to increased plasma testosterone in relation to parental behavior.

-Previous research done during the egg incubation stage supported female insensitivity to high T.^{4,5}

-Results from the nest intrusions suggest that maternal aggression is not mediated by testosterone.

-Male's increased provisioning rate may counteract negative effects of reduced female brooding.

-Results are consistent with the constraint hypothesis. More data needed on nestling growth rates, survivorship, and fitness of offspring as adults.



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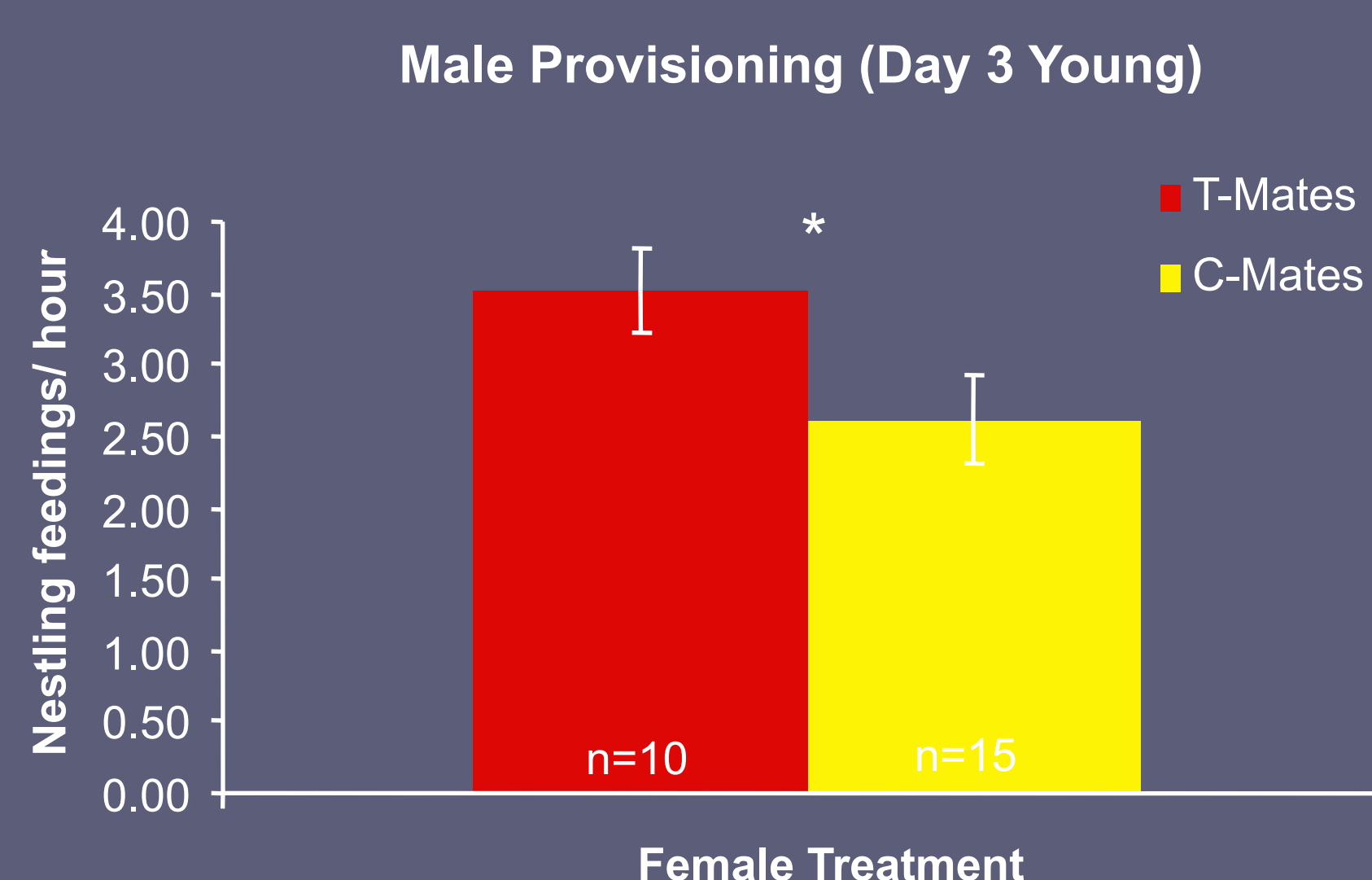
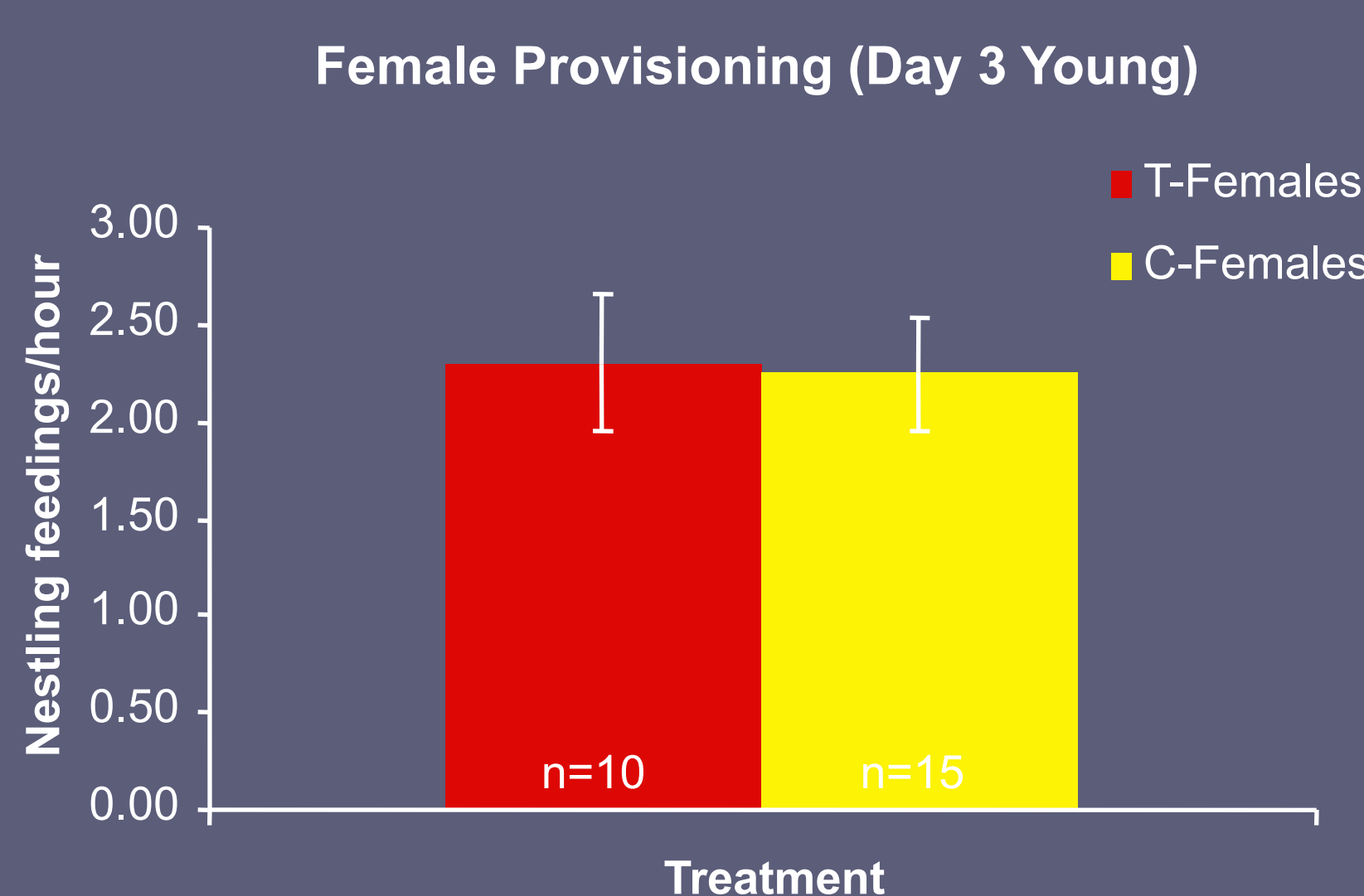
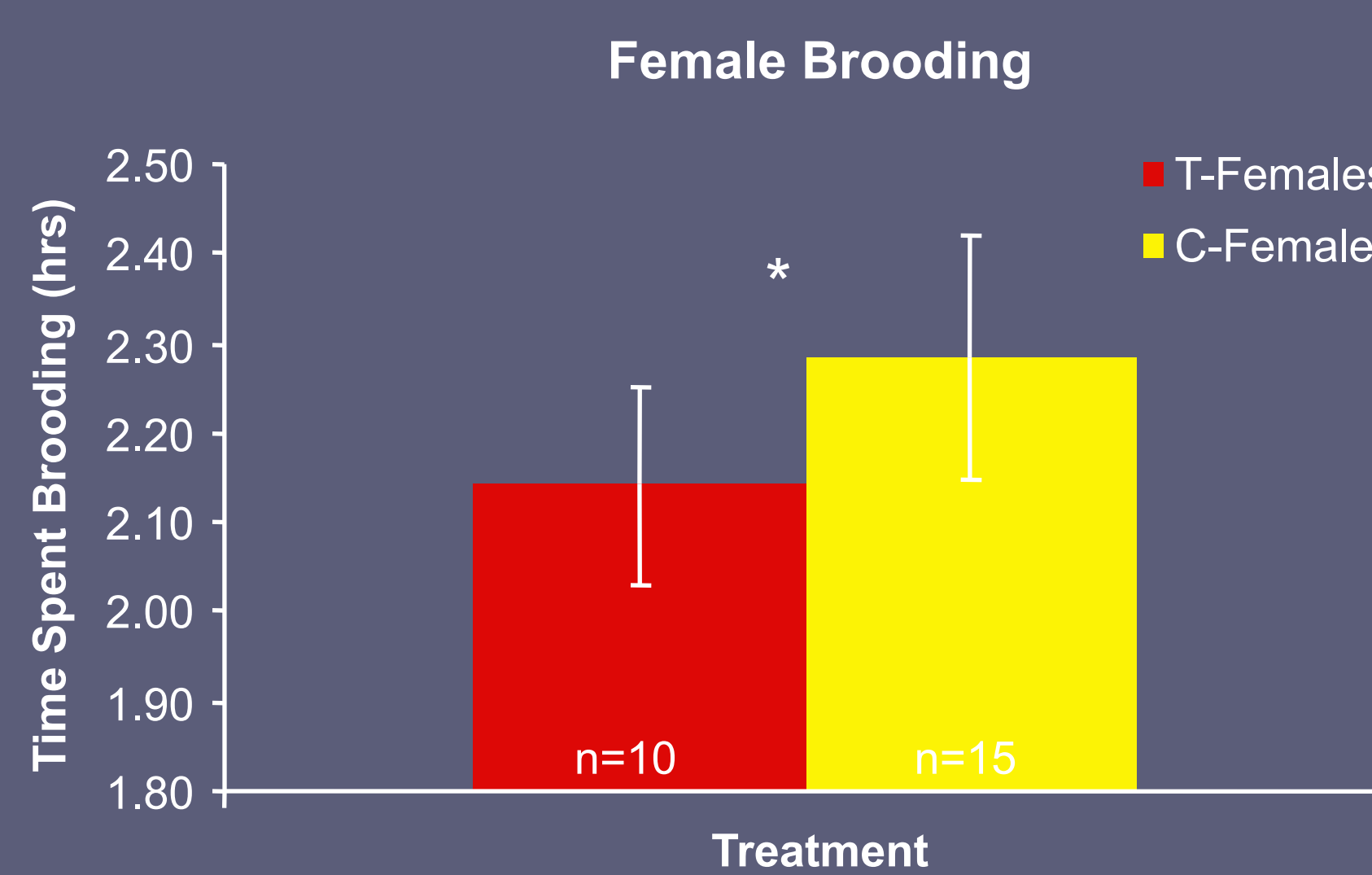
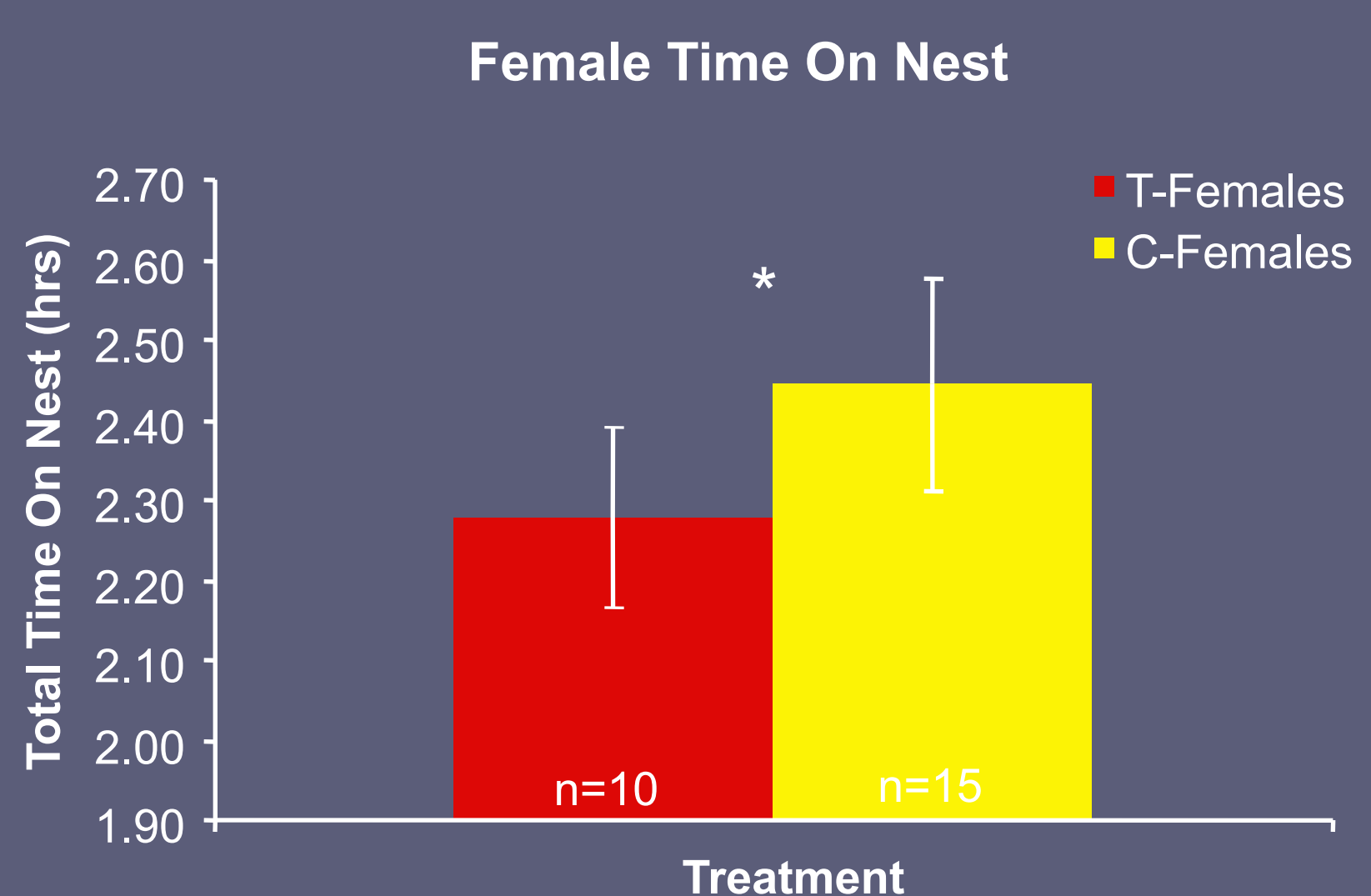
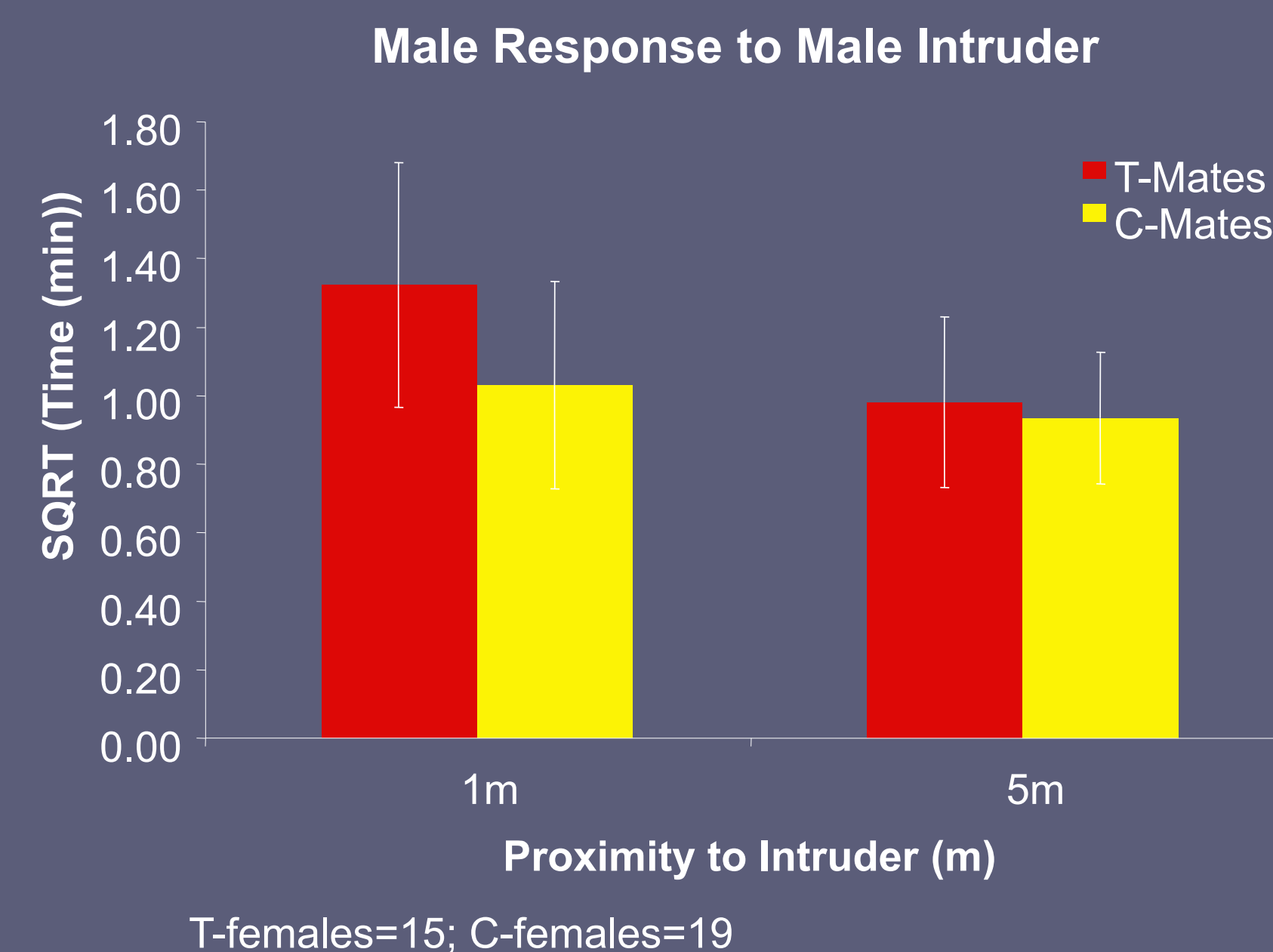
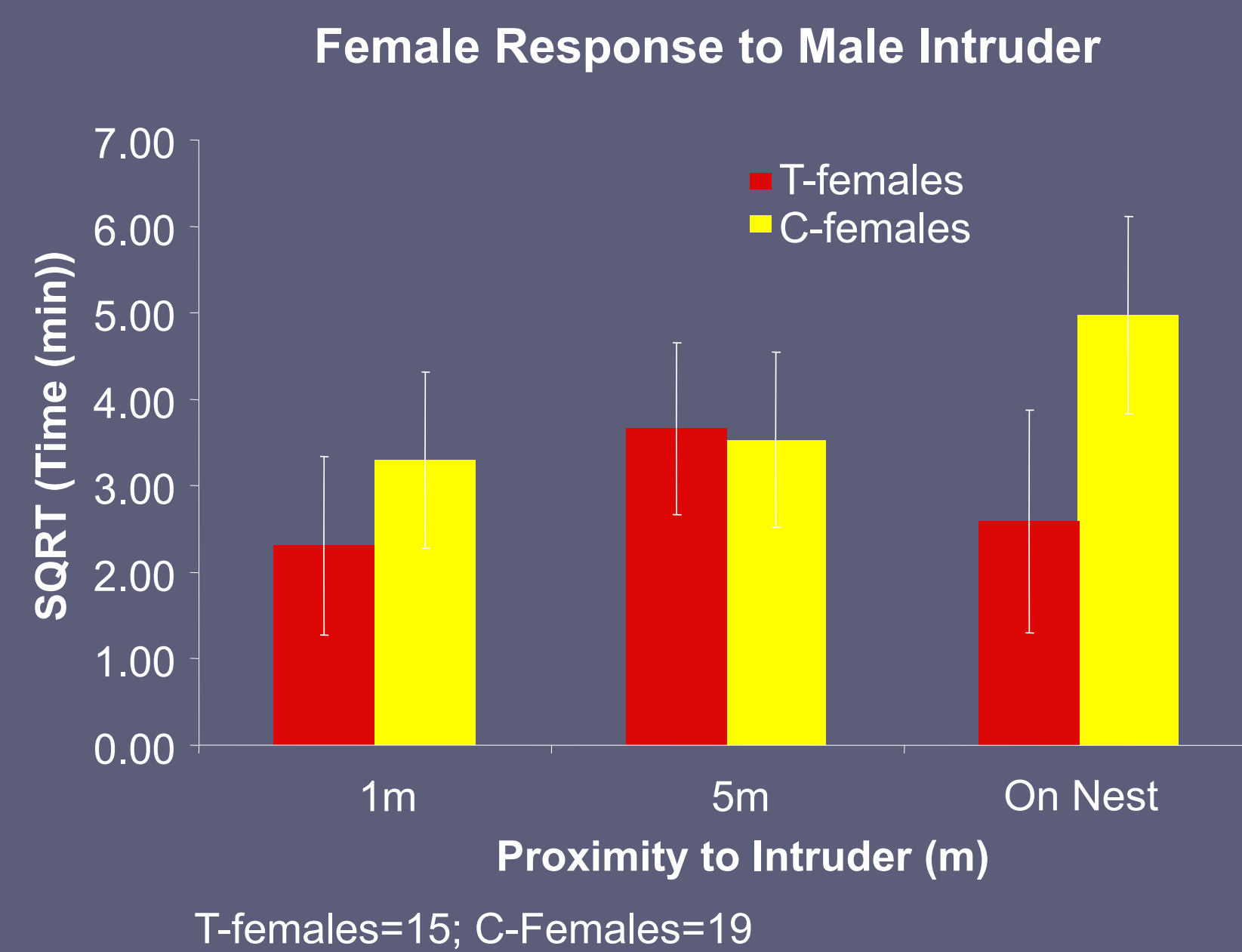
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